



Technical Data

Thermal Performance

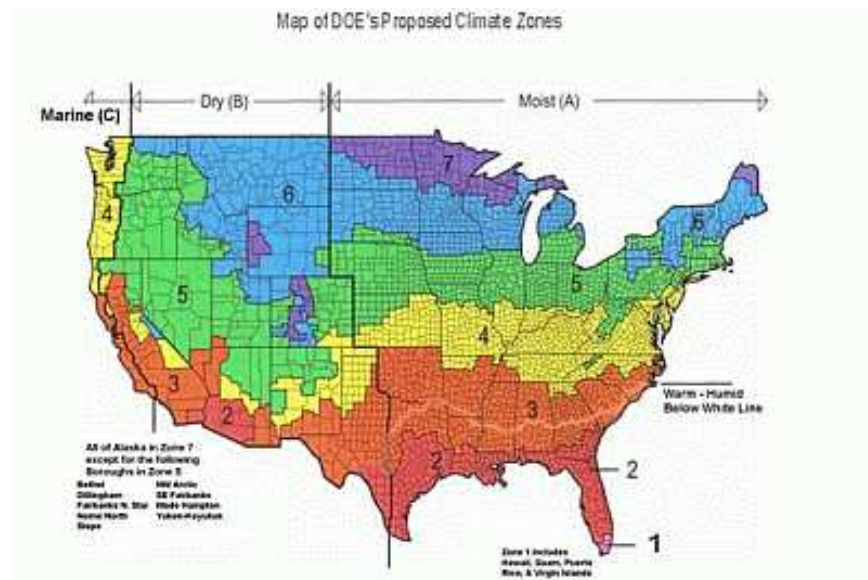
The DBMS (Thermal Mass Multiplier) values for RASTRA walls are based on computer simulation for the eight representative U.S. climates by Oak Ridge Laboratories*. These values are given for 8 representative climate zones according to Department of Energy (DOE). The resulting dynamic (effective) R-values for four different thicknesses of RASTRA are illustrated.

U.S. Department of Energy Oak Ridge National Laboratory RASTRA-Specific Tests				RASTRA R-values Panel Thickness and Climate Zone ³				Min. reqd. R-value by DOE
DOE Climate Zone	Representative Cities	Thermal Mass Multiplier ¹ (TMM)	R – Value p. Inch ² 1.73* ² TMM	8.5" Panel 4[5.5" Thastyron]	10" Panel [6.5" Thastyron]	12" Panel [8.5" Thastyron]	14" Panel [10.5" Thastyron]	Prescrip- tive Table ⁷
1	Miami	1.79	N/A	15.6	19.7	27.7	37.8	13/6
2	Phoenix	2.17	N/A	18.9	23.8	33.6	45.9	13/6
3	Atlanta	1.98	N/A	17.2	21.7	30.7	41.8	13/6
4 except Marine	Washington DC	2.02	N/A	17.6	22.2	31.3	42.7	13/8
5 and Marine 4	Denver	2.10	N/A	18.2	23.1	32.6	44.4	19/13
6	Minneapolis	2.05	N/A	17.8	22.6	31.8	43.4	19/15
7 + 8	Alaska	1 ⁵	1.73 ⁶	8.7	11.0 ⁶	16.0 ⁶	22.5 ⁶	21/21

1. Thermal Mass Multiplier (TMM) represents the influence of thermal mass upon the insulating capacity of a wall. (Steady-state R-values were developed for traditional wood-frame walls and do not include the Thermal Mass Benefit.) Variations according to climate zone reflect the influences of temperature and humidity.
2. The non-mass steady-state R-value for THASTYRON is 1.73/in. When the Thermal Mass Benefit is included, the resulting R-value is shown. No TMM is applied to flat panels with a thickness under 4".
3. The equivalent thickness of THASTYRON (the RASTRA insulating material) per RASTRA panel assumes a layer of concrete between two layers of THASTYRON. The combined thickness of the THASTYRON layer can be approximated as follows:

$$\{\text{Wall thickness} - 3.5'' (3'') \text{ concrete} = \text{number of inches THASTYRON}\}$$
This simplified calculation matches the testing and computer simulation that was conducted. The R-value of the assembly, however, increases slightly exponentially with increasing thickness. The TMM decreases with more insulation around the concrete (mass). These tendencies have been considered in the values for 12" and 14" walls.
4. The 8.5" thick RASTRA panel has not been tested separately. The values in this column are calculated values, based on other tests.
5. Per DOE Prescriptive Table, Thermal Mass Benefit is not considered in climate zones 7 + 8. The minimum required steady-state R-value is 21.

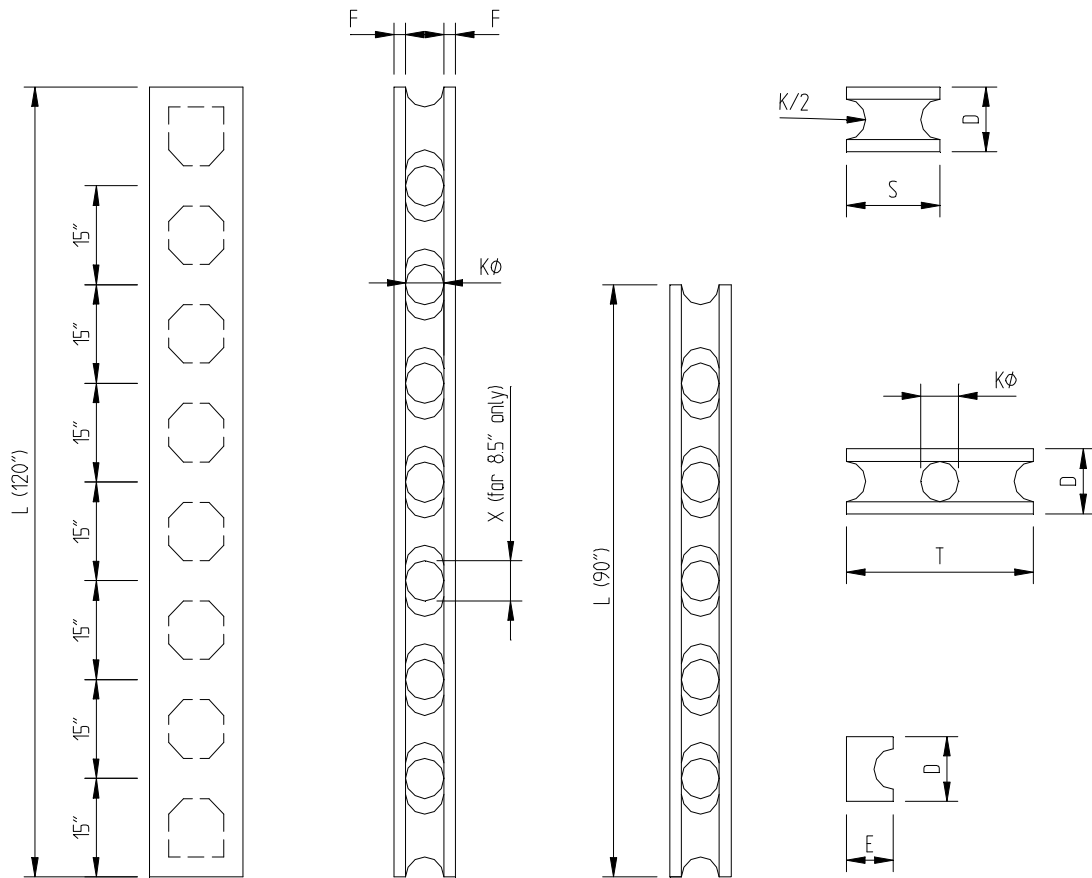
6. Steady-state R-values per testing.
7. These are prescriptive values, which are general in nature. The first number is the steady-state R-value that is prescribed for non-mass walls (frame); the second is the steady-state value that is required for mass walls unless there is an established, specific TMM higher than the prescriptive multiplier.



Remark: *Computer simulation has been based on a steady-state R-value of 7.6 and a 10" thick wall made of 25lbs/ft³ EPS concrete. Slight variations in DBMS values for other thicknesses and basic R-values may result.

For all building systems, the "clear" wall R-value (as measured in hot box or hot plate tests) is higher than it is for the total house. Some building details (corner designs, studs) are designed in a way that they interfere with the insulating envelope. That design may account for a reduction in the total-house R-value of up to 35%. According to research of RASTRA details by ORNL, the total-house R-value will not differ more than 3.2%. For wood frame this value is usually >9%. Other benefits, such as the tightness of the building or wall-surface temperature, also have an influence. These and other factors contribute to the real performance, as utility-use data supplied by residents of RASTRA houses show savings in excess of 50% in some instances.

Dimensions



Dimensions – ins (mm)

Thickness	Core Diameter	Flange	Length	Single Height	Double Height	End Panel Depth	Core Diameter
D	K	F	L	S	T	E	X
8.5"(215)	5"(127)	1.75"(45)	90"(2286)	15" (380)	30"(760)	NA	5.25"(135)
10"(250)	6"(152)	2"(50)	120"(3050)			NA	
12"(305)	6"(152)	3"(76)				7.5"(190)	NA
14"(355)	6" (152)	4"(100)				NA	

Note: 8.5" panels are used for interior or low load bearing applications only
 14" (355mm) thick panels can be ordered with 8" (203mm) diameter cores.

Volumes & Weights

STANDARD PANELS

Thickness	Length	Standard Panel -cubic feet (dm ³)			End Panel	Weight Std. Panel-lbs (kg) (110lb)
		Outside	Cavity	Net	Net	
8.5"(215)	90"(2286)	6.64 (188)	1.97 (56)	4.67 (132)	-	112 (51)
10"(250)	120"(3050)	10.42 (294)	3.67 (104)	6.75 (190)	4.22 (119)	158 (72)
12"(305)		12.5 (354)		8.83 (250)	5.26 (149)	197 (90)
14"(355)		14.58 (412)		10.91 (308)	6.31 (178)	243 (110)
			6.68 (185)*	7.90 (55)	5.55 (157)	175 (79)

Note: 8.5" panels are used for interior non load bearing applications only.

* 14" thick panels can be ordered with 8" cavities for higher strength requirements.

FLAT PANELS

Thickness	Width	Length	Weight
2" (50)	30" (760)	60" (1520)	50 lbs (22.5 kg)
4" (100)			100 lbs (45 kg)

Fabrication Tolerances

RASTRA panels are shaved to size after they are produced. This allows for very small tolerances and makes it possible to obtain straight and smooth walls. Below is a typical excerpt of the Quality Control Sheet for the production of RASTRA panels, showing permissible tolerances at the time of production:

Tolerance*	D	F	F	L - long	L - short	E	S	T	J****
8.5"	± 1/8"	-1/2" ***	± 3/8"	+1/2"	+1/2"	+1/2"	±3/32"	±3/32"	1/2"
10"	± 1/8"		+1/2", -3/8"						
12"	± 1/8"		± 1/2"	-3/8"	-3/8"	-5/8"			
14"	± 3/16"		± 5/8"						

Straightness: Maximum camber out of plane over L = <1/2"

Maximum camber in plane over L = <1/8"

* Due to the nature of the product [1/8"] has to be considered the minimum reliably measurable dimension, thus a generally allowable tolerance.

** Openings may be oblong instead of round, created by reducing the thickness of 10" panels in the center. Tolerance is valid in longitudinal direction of panel. In perpendicular direction tolerance results from flange thickness.

*** Cavity openings may be produced oblong to meet structural requirements. An upper (+) tolerance is not specified, it will result from the flange thickness (F).

**** J represents the offset of centers of the openings of the two panel halves in either direction.

General Data

RASTRA Panel	Concrete Consumption
8 ½" wide	0.21 cuft per sqft (65 dm ³ /m ²) of wall surface
10", 12" & 14" wide	0.30 cuft per sqft (65 dm ³ /m ²) of wall surface
Approximate Weight of Grouted Unfinished Wall	
8 1/2"	42 lbs per square foot (201 kg/m ²)
10"	57 lbs per square foot (274 kg/m ²)
12"	60 lbs per square foot (288 kg/m ²)
14"	64 lbs per square foot (307 kg/m ²)
Reinforcement Consumption	
15" centers	1.17 lineal feet (36m) per square foot of wall surface
30" centers	0.85 lineal feet (0.25m) per square foot of wall surface

Physical Properties

Parameter (report numbers)	Rating/Value	Remarks
Recycled Content	± 85% by volume	Mainly post-industrial expanded polystyrene (EPS).
Bulk Density	22 lbs/ft ³ ± 10%	Panels for specific applications may be produced with higher density.
Compressive Strength of THASTYRON	56 psi	Depending on density required.
Tensile Strength of THASTYRON	43 psi	Depending on density required.
Water Vapor Transmission PI-4582/ws, 5/80	7.3	This is a (dimensionless) factor to measure possibility of condensation in the wall, particularly in cooler periods or with high air conditioning; the low value of Thastyron is a guarantee that no condensation will occur.
Fire Endurance UL – R14366, 9/91, 2/99	4 hour rating (ASTM E119)	A 10" un-plastered RASTRA wall has been tested for 5 hours under a load of 10,000 lbs/lin.ft.; two tests have been performed with an additional positive and negative load perpendicular to the wall, simulating a 35 mph wind pressure; with a temperature in excess of 2000°F on the exposed side the surface temperature on the unexposed side of the wall did not increase for more than 7°F; a high pressure water stream directed towards the wall immediately after burning did not penetrate the wall.
Thermal Barrier (Room Fire Test) OPL – 15715-1808, 9/97	no flame spread no smoke development wall meets UBC 26-3	A wood crib is burned in a corner built with un-plastered RASTRA walls exposing it to 1700°F +/-; flame spread, smoke and any damage of the wall is monitored.
Surface Burning Characteristic SGS – 113924. 9/98	Flame Spread Index 0 Smoke Development Index 5 NFPA Class A UBC Class 1 ASTM E 84 (NFPA 255, UBC 8-1)	4" thick Thastyron panels were exposed to flame and spreading of the flame front and smoke density, compared to red oak was measured. The flame front was produced at less than 6", which is within the flame spread of the burner. For smoke development light absorption is measured. The test showed some very low absorption, for the test result values are always rounded to the next figure divisible by 5.

Frost Resistance TIB – KR/SI, 10/84	Highly Frost Resistant	Thastyron soaked in boiling water and frozen at -4°F; after 50 cycles no reduction of compressive strength could be found.
Toxicity BI – 08-95-0338, 5/95	Low Toxic	Testing conducted using Leaching Procedure by EPA SW-846 method 1311, metals by method 6010 & 7470, volatiles by method 8240; metals are less than 1/20 of regulatory limit, only traces of 4 volatiles out of 40 tested found.
Formation of Mildew API – 17137, 4/83	No mildew & fungus growth including black mold	Test cubes were kept under moist conditions for 40 days after inoculation of test germs (aspergillus niger, rhizopus nigricans). No growth of cultures could be observed; formation of mycel or konidien culture did not take place.
Water Transmission ATI – 03-30070.01, 12/98 ATI – 03-30305.01, 12/98	Meets requirements ASTM E331, ASTM E514, meets UBC 14-1	10" thick RASTRA wall with skim coat has been exposed to a water spray with a flow rate of 5.0 USgal/ft ² /hr at a differential pressure to simulate a 125mph wind. (extended testing done by US Navy and met standards).
Average Wall Humidity MA-39 – f711/83, 10/83	Average 2.5% by volume	Samples taken from a home more than 5 years in use from areas where most humidity is expected.
Expansion TUG – 52.620/83, 7/83	0.0018inch/ft (as standard concrete)	Even as RASTRA panels without concrete grout show shrinking and swelling in changing humidity, shrinkage is neglectible once the concrete is poured.
Thermal Performance MPA – 970344-Hu, 1/98	Effective R-values 20 to 49 h.°Fs.f./Btu	European testing on a 1.5m x 1.5m, and US testing of 8'x8' walls revealed heat conductivities of 0.084 to 0.053 Btu/h°F/ft of dry, grouted 10", 12" and 14" walls. DBMS values between 1.79 and 2.17 have been established for 6 U.S. climate zones. Energy usage shows even better efficiency.
Sound Insulation BVFS – U3/19A/87, 2/87 MA-39 – F956/85, 6/85	>50dB(a)	Tests have been taken in laboratories and in real buildings; as dB is logarithmic. The difference between 27dB (good for a 2x4 framed wall) and a 50dB RASTRA wall result in 199% lower sound intensity. The value indicated results is an average measured on a band width of 100 to 3150 Hz.